Evaluation of the efficacy of a non-penetrating captive bolt to euthanase neonatal goats up to 48 hours of age

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Abstract

Manual blunt force trauma is a common method of euthanasia or culling of goat kids, however it is difficult to apply consistently and may vary in effectiveness. Therefore, a controlled mechanical method is needed. The overall objective of this research was to evaluate the effectiveness of a non-penetrating captive bolt (NPCB) to euthanase goats (Capra hircus) up to 48 h of age. In a pilot study (n = 27), the optimum anatomical site for placement of the NPCB was evaluated using signs of insensibility and death, and post mortem assessment of traumatic brain injury. Three different anatomical sites (frontal bone, poll or behind the poll) were evaluated. In Experiment 1 (n = 100), goats were euthanased using the optimum anatomical placement determined in the pilot study and the presence of brainstem reflexes, rhythmic respiration, convulsions and cardiac activity were recorded. In Experiment 2 (n = 7), electroencephalogram (EEG) was recorded to assess awareness following application of the NPCB. Results from the pilot study showed that immediate insensibility followed by death was achieved when the muzzle of the NPCB was positioned behind the poll and the goat’s head was bent so that the chin touched the chest. In Experiment 1, all goats were rendered immediately insensible without return to sensibility prior to cessation of cardiac activity. In Experiment 2, application of the NPCB resulted in the immediate onset of EEG activity which was incompatible with awareness. In conclusion, the NPCB reliably caused immediate insensibility and death in goats up to 48 h of age.

Keywords: animal welfare, electroencephalogram, euthanasia, goats, insensibility, non-penetrating captive bolt

Introduction

In this paper we are exploring a novel technique for humane dispatch of neonatal goat kids for euthanasia or culling circumstances. In livestock production occasions arise where individual animals need to be killed to reduce suffering (euthanasia) or because they have little or no economic value (culling). Although we recognise the utility of this proposed technology in both of these situations, for simplicity we use the term euthanasia throughout this manuscript.

Manually applied blunt force trauma (BFT) is a common method of euthanasia and culling for many neonatal species, including goat kids. However, manually applied BFT is difficult to apply consistently, is often aesthetically unpleasant for operators to perform and poses a significant public perception concern. In contrast, mechanically applied BFT performed using a penetrating (PCB) or non-penetrating captive bolt (NPCB) can deliver an appropriate and uniform amount of force resulting in more consistent structural damage to the brain (American Veterinary Medical Association [AVMA] 2013). Therefore, industry and farm operators have recognised that there is a need to evaluate mechanical methods of BFT that cause immediate insensibility and death with minimal pain and distress to the animal.

Finnie et al (2000) found that an NPCB produced sufficient traumatic brain injury to suggest that it is an acceptable method of euthanasia for 4- to 5-week-old lambs. Similarly, an NPCB device was found to be effective for euthanasing pigs (Sus scrofa) less than three days of age (Casey-Trott et al 2013), pigs weighing 3–9 kg (Casey-Trott et al 2014) and turkeys (Meleagris gallopavo) (Erasmus et al 2010a,b). However, little is known regarding the effectiveness of an NPCB as a method of euthanasia for goats up to 48 h of age. When using mechanical methods of BFT to euthanise animals, correct anatomical placement is critical to ensure that adequate damage occurs to vital structures of the brain in order to cause immediate and sustained insensibility and death. In a study of PCB euthanasia of 489 sheep, 6% of animals showed signs of incomplete concussion, all of which were associated with inaccuracy of the shot upon post mortem examination and the bolt missed the brain entirely in 79% of these animals (Gibson et al 2012). For euthanasia of neonatal goats (Capra hircus), the AVMA (2013) recommends that the PCB be placed on the intersection of two lines going from the lateral canthus of the eye to the horn on the opposite side. According to the World Organisation for Animal Heath Terrestrial Animal Health...